

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-28 are presently active in this case, Claims 1, 2, 27 and 28 amended by way of the present amendment.

In the outstanding Office Action, the previous rejection was withdrawn and a new non-final rejection was issued; the IDS filed October 30, 2006 was objected to; Claims 1-18, 27 and 28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Publication 2004/0168705 to Sun et al. in view of U.S. Patent No. 5,993,679 to Koide et al.; Claims 19-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sun et al. in view of Koide et al., and further in view of U.S. Patent Publication 2004/0084409 to Deshmukh et al.; Claims 24-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sun et al., Koide et al., and Deshmukh et al., and further in view of U.S. Patent No. 5,403,434 to Moslehi.

First, Applicants wish to thank Examiner Stouffer and Supervisory Patent Examiner (SPE) Meeks for the March 5, 2007 personal interview at which time the outstanding issues in this case were discussed. During the interview, Applicants presented amendments and arguments substantially as indicated in this response. While no agreement was reached, the Examiners indicated that they would give full consideration to the arguments and amendments presented when filed in a formal response.

With regard to the IDS filed October 30, 2006, Applicants note that this IDS submitted a PCT search report for consideration. The sole reference cited in the International Search Report was not listed on a PTO Form 1449 because this reference was already of record in this case.

Turning now to the merits, Applicants' invention is directed to an improved method for removing fluoro-carbon polymer chamber residue from a plasma processing chamber using a dry cleaning process. As discussed in the Background section of Applicants' specification, over time, fluoro-carbon polymer residue can accumulate in the process chamber and flake off thereby generating particle contamination in the process chamber and on processed substrates. Conventional dry cleaning methods for removing these contaminants were often ineffective, and typically required a substrate shield to protect the sensitive material of the substrate holder from the dry cleaning process. Applicants' invention is directed to improving the dry cleaning process and/or avoiding the requirement for using a substrate shield during the dry cleaning process. Applicants' claims have been amended to emphasize these features.

Specifically, Applicants' Claim 1 recites a method of removing fluoro-carbon polymer chamber residue from a plasma processing system. The method includes introducing a process gas including a gas containing carbon and oxygen into a process chamber of the plasma processing system, and generating a plasma from the process gas. Also included in Claim 1 is exposing the fluoro-carbon polymer chamber residue to the plasma in a dry cleaning process to form a volatile reaction product from the residue, and exhausting the reaction product from the process chamber. Thus, Applicants' Claim 1 has been amended to emphasize that the method is for removing fluoro-carbon polymers from the plasma processing system. Applicants' independent Claims 27 and 28 have been similarly amended to include this feature in system claim format. Still further, Applicants' Claim 2 has been amended to recite that the exposing includes a waferless dry cleaning process where a shield wafer is not provided on a substrate holder of the plasma processing system so that the substrate holder is cleaned by the waferless dry cleaning process.

In contrast, the cited reference to Sun et al. discloses a method of cleaning a surface of a copper sublayer of a substrate. As seen in Figure 3e, a contaminant region 310 (for example an oxide) can develop on a copper metal sublayer 302 within a trench feature 306 of a substrate. Prior to filling the trench feature with bulk copper, the contaminant region 310 is removed by exposing the copper sublayer to a suppressant species that can include carbon and oxygen. Sun et al. makes clear that treatment of the sublayer is to remove the oxide contaminant and not the copper sublayer 302 itself. Thus, Sun et al. does not disclose cleaning a chamber at all. Further, Sun et al. does not disclose removing fluoro-carbon polymer residue from a process chamber as now required by Applicants' independent claims.

The outstanding Office Action acknowledges that Sun et al. does not clean a process chamber, but cites Koide et al. as correcting this deficiency. Koide et al. discloses a method of cleaning metallic films from the interior of a deposition apparatus without generating particulates or flakiness. As discussed throughout Koide et al., this chamber cleaning process includes a sequence of chemical reactions performed in turn by oxidizing the metallic copper, complexing the copper oxide, and sublimating the complex copper oxide in order to remove the metallic copper by chemical gas phase etching. There is no discussion in Koide et al. of using a gas of carbon and oxygen to clean the copper film from the interior of the chamber. Moreover, Koide et al. is directed to removing metallic copper from the interior of the process chamber, and copper oxide is formed as part of this cleaning process. That is, Koide et al. is not concerned with cleaning copper oxide from the plasma chamber.

Applicants first submit that there is no motivation to combine Sun et al. and Koide et al. to arrive at the claimed invention. As noted above, Sun et al. discloses a carbon and oxygen plasma process for cleaning copper oxide from a substrate without removing the copper from the substrate. The cited reference to Koide et al. discloses an oxidation-complexing-sublimation process for removing copper metal from the chamber. Thus, these

processes are completely different. There is no hint in either of the references that the carbon and oxygen plasma process of Sun et al. could be effective for removing copper from a process chamber as shown in Koide et al. This is particularly true since Sun et al. is directed to removing oxides only and Koide et al. is directed to removing copper metal from the chamber. Thus, one of ordinary skill in the art would not be motivated to combine Sun et al. and Koide et al. to arrive at the claimed invention.

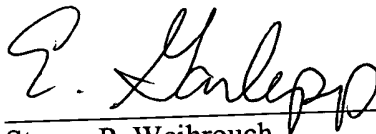
Even assuming that Sun et al. and Koide et al. would be combined by one of ordinary skill in the art, this combination will not result in the invention as now claimed in Applicants' amended claims. As noted above, Applicants' independent claims have been amended to clarify that the gas containing carbon and oxygen is provided to remove fluoro-carbon polymer residue from the process chamber. Neither Sun et al. nor Koide et al. disclose this feature. Moreover, the secondary references to Deshmukh et al. and Moslehi are cited for features in the dependent claims and cannot correct the deficiencies of Sun et al. and Koide et al.

For the reasons discussed above, Claims 1, 27 and 28 patentably define over the cited references. As claims 2-26 depend from claim 1, these dependent claims also patentably define over the cited references. Nevertheless, Claim 2 has been amended to recite that the exposing includes a waferless dry cleaning process where a shield wafer is not provided on a substrate holder of the plasma processing system so that the substrate holder is cleaned by the waferless dry cleaning process. As discussed in applicants specification, the claimed cleaning process allows improved cleaning of the substrate holder so that particulate contamination will not occur in processed wafers. Claim 2 emphasizes this point. None of the cited references teach or suggest this feature, which provides an additional basis for patentability of Claim 2.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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